

## THE EFFECT OF FAMILY SUPPORT ON MAGNITUDE OF LIMITATIONS AMONG PATIENTS WITH EXTREMITY TRAUMA

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### Abstract:

*Purpose* Family support may affect magnitude of limitations. This study assessed the direct relationship between family support (measured with the Family APGAR score) and magnitude of limitations (measured with the Patient-Reported Outcomes Measurement Information System Physical Function Computer Adaptive Test; PROMIS PF CAT) within 1 month after extremity trauma or surgery.

*Methods* In this cross-sectional study, 174 patients presenting within 1 month of extremity trauma or surgery (49% woman, average age  $47 \pm 18$ ) completed (1) a demographic questionnaire consisting of gender, age, race, marital status, level of education, occupation and family demographics including number of immediate family members in the household and race of the family members; (2) patient's perceived level of family functionality and satisfaction using the Family APGAR score; and (3) PROMIS PF. We recruited patients of six participating orthopedic offices in a large urban area.

*Results* A small correlation was found between PROMIS PF and level of family support in patients within 1 month of extremity injury treated with or without surgery ( $r$  0.18;  $P=0.040$ ). In the multivariable linear regression model, higher perceived family support ( $\beta$  0.88; 95% CI 0.14 to 1.6;  $P=0.019$ ; Semipartial  $R^2$  0.03; Adjusted  $R^2$  full model=0.19) and lower patient age ( $\beta$  -0.18; 95% CI -0.30 to -0.06;  $P=0.003$ ; Semipartial  $R^2$  0.06) were independently associated with better perceived physical function.

*Conclusion* Family support can ease recovery from extremity trauma. Efforts to optimize family involvement in patient care can be strategized, starting by identifying the patient's local support system, perhaps more so for older patients. Social services, care managers, and home health agencies may help create a temporary support system.

**Keywords:** Family Support; Physical Function; Family APGAR; PROMIS PF.

### INTRODUCTION

The Universal Declaration of Human Rights Article 16/3 developed by the United Nations General Assembly in 1948 states that "The family is the natural and fundamental group unit of society and is entitled to protection by society and the state" ("Universal Declaration of Human Rights," 2006). The concept of patient-centered care can be expanded to family-centered care in recognition of the importance of family context (Bamm & Rosenbaum, 2008). Approximately 30-38 million family caregivers in the United States are helping patients manage illness and

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helping to implement treatment recommendations. (Mitnick, Leffler, & Hood, 2010).

Social factors such as feeling cared for and perceiving that others are available to help with specific tasks help buffer the effects of stress and illness (Nota et al., 2016). In patients with persistent pain, these social supports are associated with fewer physical limitations (Gilson, 2002; Jamison & Virts, 1990; Lim, Manching, & Pensegera, 2012; Nota et al., 2016; Prang, Newnam, & Berecki-Gisolf, 2015). The nuclear family is often the primary source of social support for patients and they are the people that clinicians want to include when discussing diagnosis, prognosis, and course of treatment. (Bamm & Rosenbaum, 2008).

This study assessed the relationship of patient perception of familial support and magnitude of limitations among patients with extremity trauma within 1 month of trauma or surgery in bivariate and multivariable analyses.

## Materials & Methods

### *Study Design*

After institutional review board approval of this prospective, cross-sectional study, patients who visited one out of six participating orthopedic offices over an 8-month period were invited to participate in this study. A research assistant not involved in patient care recruited patients directly after their visit in the office. Inclusion criteria were patients within 1 month of extremity trauma or surgery, aged between 18 and 89 years old, and English fluency and literacy. Exclusion criteria included patients with injury or surgery expected to cause disability for less than 2 months and patients who were unable to complete enrollment forms. We were granted a waiver of documentation of informed consent, completion of the questionnaires implied consent.

### *Outcome Measures*

Patients were asked to complete a set of questionnaires in the following order: (1) a demographic illness questionnaire consisting of gender, age, race, marital status, level of education, occupation and family demographics consisting of number of immediate family members in the household and race of family members; (2) patient's perceived level of family functionality and satisfaction using the Family APGAR score; and (3) Patient-Reported Outcomes Measurement Information System (PROMIS) Physical Function (PF) Computer Adaptive Test (CAT).

Family APGAR (Adaptation, Partnership, Growth, Affection and Resolve) is a validated questionnaire with five parameters of family functioning: adaptability, partnership, growth, affection and resolve. (Lim et al., 2012; Wang & Huang, 2016) The response options were designed to describe frequency of feeling satisfied with each parameter on a 3-point scale (Appendix 1). (Wang & Huang, 2016). Total score of the Family APGAR will be between 0 and 10, where a higher score indicates higher support. (Lim et al., 2012; Wang & Huang, 2016).

PROMIS Physical Function measures magnitude of limitations by assessing the patient's ability to accomplish physical activities ranging from low-impact tasks (e.g. dressing) to high-impact physical activities (e.g. running) (Cella et al., 2010; Hung, Clegg, Greene, & Saltzman, 2011; Overbeek, Nota, Jayakumar, Hageman, & Ring, 2015). Based on prior questions, PROMIS is using CAT algorithms to assign subsequent questions (Cella et al., 2010). The overall score can range from 0 to 100. Higher scores indicate better physical function (Hung et al., 2011; Nota et al., 2016; Overbeek et al., 2015).

All questionnaires were completed on a tablet via secure, HIPAA-compliant electronic platform: REDCap (Research Electronic Data Capture: a secure web-based application for building and managing online surveys and databases). (Harris et al., 2009)

### *Study Population*

A total of 174 patients completed the questionnaires. After data collection, 37 (21%) patients were excluded from analyses because of incorrect inclusion (not an extremity trauma or the diagnosis had an expectation shorter than two months). The remaining 137 patients had a mean age of  $47 \pm 18$  years old (range 18-81). Seventy (51%) patients were men and 68 patients (50%) were injured at their upper extremity. The median amount of family members in the household, besides the patients, was 1 (interquartile range 1-3) and 117 (85%) patients had the same race as their family members (Table 1).

**Table 1. Patient and clinical characteristics.**

Variables	N=137
<b>Age in years</b>	47 ± 18 (18-81)
<b>Men</b>	70 (51)
<b>Level of education</b>	
High-school	30 (22)
2-Years college	23 (17)
4-Years college	51 (37)
Post-graduate degree	33 (24)
<b>Marital status</b>	
Married/Unmarried couple	75 (55)
Single	42 (31)
Divorced/Separated/Widowed	20 (14)
<b>Race/Ethnicity</b>	
White	98 (72)
Latino/Hispanic	17 (12)
Black/African American	11 (8)
Other	11 (8)
<b>Work status</b>	
Employed	84 (61)
Retired	28 (21)
Unemployed/Unable to work	11 (8)
Other	14 (10)
<b>Family members in household</b>	1.0 (1.0-3.0)
<b>Family members same race</b>	117 (85)
<b>Injured at upper extremity</b>	68 (50)
<b>Family Apgar score</b>	10 (8.0-10)
<b>PROMIS Physical Function</b>	39 ± 11 (21-68)

Continuous variables as mean ± standard deviation (range) or median (interquartile range [IQR]); Discrete variables as number (percentage); PROMIS: Patient-Reported Outcomes Measurement Information System.

### *Statistical Analysis*

The distributions of continuous variables and assumptions concerning normality were assessed to determine the appropriateness of the statistical tests. Descriptive statistics are presented as mean ± standard deviation (range) in case of normally distributed continuous variables and median (interquartile range) for non-normally distributed variables, and number (percentage) for discrete variables. Bivariate analyses were conducted to test the association of each explanatory variable with PROMIS PF. We used Pearson and Spearman correlation coefficient for continuous variables, t-test for dichotomous variables, and one-way analysis of variance (ANOVA) for categorical variables. Variables with  $P < 0.10$  were included in a multivariable linear regression model with PROMIS PF. Because family support, patients' race and family ethnic background were the variables of interest, we included these in another multivariable linear regression model, independently of the bivariate results. The regression coefficient ( $\beta$ ) indicates the change in the value of a dependent variable corresponding to the unit change in the independent variable. The higher the absolute value of the coefficient, the stronger the effect of the relationship. There are no fixed cut off scores. Adjusted R-squared ( $R^2$ ) values indicate the amount of variability in the dependent variable that the model accounts for. Semipartial  $R^2$  expresses the specific variability of a given independent variable in the model. We considered  $P < 0.05$  significant.

An a priori power analysis was conducted with respect to the secondary null hypothesis and indicated that a sample of 136 patients would provide 80% statistical power, with alpha set at 0.05, for a regression with five predictors if family ethnic background would account for 5% or more of the variability in physical limitations (PROMIS PF), and the complete model would account for 15% of the overall variability. Including 5-8% extra to account for incomplete or incorrect data, a total of 147 were enrolled.

## RESULTS

### *Correlation PROMIS Physical Function and Familial Support*

There was a small correlation between magnitude of limitations (PROMIS PF) and level of familial support within 1 month of extremity injury treated with or without surgery ( $r$  0.18;  $P=0.040$ ; Table 2).

**Table 2. Bivariate analyses of factors associated with PROMIS PF.**

Variables	PROMIS PF	P value
<b>Age in years (<math>r</math>)</b>	-0.17	<b>0.049</b>
<b>Sex</b>		
Women	36 ± 9.2	<b>0.002</b>
Men	42 ± 12	
<b>Level of education</b>		
High-school	39 ± 9.5	0.978
2- Years college	39 ± 11	
4- Years college	39 ± 11	
Post-graduate degree	40 ± 12	
<b>Marital status</b>		
Married/Unmarried couple	41 ± 12	<b>0.032</b>
Single	39 ± 9.2	
Divorced/Separated/Widowed	34 ± 7.8	
<b>Race/Ethnicity</b>		
White	39 ± 11	0.126
Latino/Hispanic	43 ± 11	
Black or African American	42 ± 9.7	
Other	33 ± 6.4	
<b>Work status</b>		
Employed	40 ± 12	0.565
Retired	37 ± 9.5	
Unemployed / Unable to work	37 ± 9.9	
Other	40 ± 11	
<b>Family members in household (<math>r</math>)</b>	0.14	0.104
<b>Family members' race</b>		
Same race	37 ± 11	0.148
Other race	36 ± 7.7	
<b>Anatomical region</b>		
Upper extremity	42 ± 11	<b>0.005</b>
Lower extremity	36 ± 11	
<b>Family Apgar Score (<math>r</math>)</b>	0.18	<b>0.040</b>

**Bold** indicates statistically significant difference; Pearson and Spearman correlation indicated by  $r$ ; Continuous variables as mean ± standard deviation; PROMIS: Patient-Reported Outcomes Measurement Information System; PF: Physical Function.

### *Factors Associated with Perceived Physical Function*

More familial support (higher family APGAR score) was independently associated with better physical function, accounting for other variables using multivariable analysis ( $\beta$  1.0; 95% CI 0.26 to 1.7;  $P=0.008$ ; Semipartial  $R^2$  0.04; Adjusted  $R^2$  full model=0.17; Table 3), and older age was independently associated with worse physical function ( $\beta$  -0.16; 95% CI -0.28 to -0.04;  $P=0.008$ ; Semipartial  $R^2$  0.06).

**Table 3. Multivariable linear regression analyses of factors associated with PROMIS PF.**

Dependent variables	Retained variables	Regression coefficient [ $\beta$ ] (95% Confidence interval)	Standard error	P value	Semipartial $R^2$	Adjusted $R^2$
PROMIS Physical Function	<b>Age in years</b>	-0.16 (-0.28 to -0.04)	0.06	<b>0.008</b>	0.05	
	<b>Men compared to women</b>	3.3 (-0.32 to 6.9)	1.8	0.074		
	<b>Marital status</b>					
	Married/Unmarried couple	Reference value				
	Single	-3.8 (-8.4 to 0.71)	2.3	0.097		0.17
	Divorced/Separated/ Widowed	-1.6 (-7.2 to 4.1)	2.9	0.585		
	<b>Lower extremity compared to upper extremity</b>	-3.2 (-6.8 to -0.40)	1.8	0.081		
	<b>Family Apgar Score</b>	1.0 (0.26 to 1.7)	0.37	<b>0.008</b>	0.04	

**Bold** indicates statistically significant difference; Only the semipartial  $R^2$  of significant variables is displayed; PROMIS: Patient-Reported Outcomes Measurement Information System.

*Factors Associated with Perceived Physical Function, Including Race and Family Ethnicity*

Family ethnic background and race of family members were not significantly correlated (Table 2), nor independently associated with PROMIS PF (Table 4). Less familial support ( $\beta$  0.88; 95% CI 0.14 to 1.6;  $P=0.019$ ; Semipartial  $R^2$  0.03; Adjusted  $R^2$  full model=0.19; Table 4), and older age ( $\beta$  -0.18; 95% CI -0.30 to -0.06;  $P=0.003$ ; Semipartial  $R^2$  0.06) were still independently associated with worse physical function in this model.

**Table 4. Multivariable linear regression analyses of factors associated with PROMIS PF, including race and family ethnicity**

Dependent variables	Retained variables	Regression coefficient [ $\beta$ ] (95% Confidence interval)	Standard error	P value	Semipartial $R^2$	Adjusted $R^2$
PROMIS Physical Function	<b>Age in years</b>	-0.18 (-0.30 to -0.06)	0.06	<b>0.003</b>	0.06	
	<b>Men compared to women</b>	3.0 (-0.60 to 6.6)	1.8	0.101		
	<b>Marital status</b>					
	Married/Unmarried couple	Reference value				
	Single	-4.2 (-8.9 to 0.53)	2.4	0.081		
	Divorced/Separated/ Widowed	-2.4 (-8.0 to 3.2)	2.8	0.404		
	<b>Race/Ethnicity</b>					0.19
	White	Reference value				
	Latino/Hispanic	3.7 (-1.6 to 9.0)	2.7	0.168		
	Black or African American	3.1 (-3.4 to 9.5)	3.3	0.352		
	Other	-5.3 (-12 to 1.7)	3.5	0.136		
	<b>Family members another race compared to the same race</b>	-2.8 (-7.9 to 2.3)	2.6	0.278		
	<b>Lower extremity compared to upper extremity</b>	-2.6 (-6.2 to 1.0)	1.8	0.161		
	<b>Family Apgar Score</b>	0.88 (0.14 to 1.6)	0.37	<b>0.019</b>	0.03	

**Bold** indicates statistically significant difference; Only the semipartial  $R^2$  of significant variables is displayed; PROMIS: Patient-Reported Outcomes Measurement Information System.

**DISCUSSION**

Social support from family can help buffer the effects of stress and illness (Nota et al., 2016). We found that patient perception of familial support is associated with physical function among patients recovering from lower or upper extremity trauma.

Our results should be interpreted in light of some limitations. First, the findings are best applied to patients recovering from extremity trauma and may not generalize to patients with other musculoskeletal pathology. Second, we did not assess the presence of family members during the visit. In general, family members are present about one-third of the time (Medalie, Zyzanski, Langa, Stange, & Strange, 1998; Omole, Sow, Fresh, Babalola, & Strothers, 2011). Having a family member present might influence patient rating of family support.

The small correlation between the perceived magnitude of limitations and degree of family support in patients recovering from extremity injury is consistent with prior evidence that family caregivers play a role in maximizing the health and quality of life for a range of illnesses (Gilson, 2002; Jamison & Virts, 1990; Lim et al., 2012; Mitnick et al., 2010; Nota et al., 2016; Omole et al., 2011; Prang et al., 2015). For example, among elderly patients with knee osteoarthritis, a higher perceived family support correlates with a better quality of life. (Lim et al., 2012) Family members are a valuable part of the healthcare team, and can help the patient accommodate physical limitations, for example by providing help with activities of daily life (Mitnick et al., 2010; Omole et al., 2011; Street, Makoul, Arora, & Epstein, 2009). Family members can also be a valuable source of health information and can act as collaborators in planning a treatment strategy. (Omole et al., 2011; Prang et al., 2015; Street et al., 2009).

The observation that the association between family support and better function was independent of family ethnic background and race of family members is in line with other studies (Ang, Ibrahim, Burant, & Kwoh, 2003; Coulton, Milligan, Chow, & Haug, 1990; Jordan et al., 1996; Lopez-Mendez, Paul, & Alarcon, 1989). A study looking at patients with self-reported symptoms and physical limitations (as measured by the Arthritis Impact Measurement Scales) found similar results for African Americans, White Americans, and Hispanic patients (Coulton et al., 1990). The Johnston County Osteoarthritis Project analyzed a rural, population-based sample of 1,197 participants from North Carolina, and they found no difference in proportions of African Americans and Whites in reporting difficulty performing tasks of basic and instrumental activities of daily living (Jordan et al., 1996). In a cross-sectional study of 250 patients with rheumatoid arthritis there was a similar disease duration, disability and functional outcome for people of various ethnicities (Lopez-Mendez et al., 1989). The observation that older age and less family support are associated with greater magnitude of physical limitations is consistent with prior evidence (Bamm & Rosenbaum, 2008; Gilson, 2002; Jamison & Virts, 1990; Lim et al., 2012; Street et al., 2009). As a result of an increasing aging population and additional chronic limitations, the main objective of the health care system has been shifting to improving function and health-related quality in life (Bamm & Rosenbaum, 2008; Street et al., 2009). It is important, especially in older patients with extremity trauma, to employ and involve all supportive system of patients to increase health, even if the limitations are only temporary.

In conclusion, family support can ease recovery from extremity trauma. Efforts to optimize family involvement in patient care can be strategized, starting by identifying the patient's local support system, perhaps more so for older patients. Attention can also be placed on referrals for service providers of social services, care managers, and home health agencies to create a temporary support system.

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**Appendix 1: Family Apgar Score**

	Almost Always	Some of the Time	Hardly Ever
1) I am satisfied that I can turn to my family for help when something is troubling me.			
2) I am satisfied with the way my family talks over things with me and shares problems with me.			
3) I am satisfied that my family accepts and supports my wishes to take on new activities or directions.			
4) I am satisfied with the way my family expressed affection and responds to my emotions, such as anger, sorrow, and love.			
5) I am satisfied with the way my family and I share time together.			